R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE DRAWINGS

Item 10 of the Office Action Summary sheet was not completed. It is respectfully requested that the Examiner confirm that the original drawings have been accepted.

ALLOWABLE SUBJECT MATTER

The Examiner's allowance of claims 5-8 is respectfully acknowledged.

THE CLAIMS

Independent claim 9 has been amended to recite that the particles comprise a material having Vickers hardness of not less than 200 Hv. See the disclosure in the specification at, for example, page 6, lines 9-14.

In addition, new claims 11 and 12, which depend from claims 9 and 10, respectively, have been amended to recite that the oil comprises silicone grease. See the disclosure in the specification at, for example, page 6, lines 17-22.

No new matter has been added, and it is respectfully requested that the amendments to the claims be approved and entered.

THE PRIOR ART REJECTION

Claims 9 and 10 were rejected under 35 USC 103 as being obvious in view of JP 7-5599 ("Honjo")[1]. This rejection, however, is respectfully traversed.

On page 2 of the Final Office Action, the Examiner acknowledges that Honjo does not disclose the features of the paste recited in claim 9 whereby the paste comprises particles having diameters of 2 μm to 40 μm, and an oil having a viscosity of 5,000 centipoises to 15,000 centipoises, wherein the particles and the oil are mixed with each other. In other words, the Examiner appears to have acknowledged that Honjo (the sole cited reference) does not disclose any of the features recited in the body of claim 9 (after the preamble).

It is respectfully submitted that Honjo also does not disclose the feature recited in amended independent claim 9 whereby the particles comprise a material having Vickers hardness of not less than 200 Hv.

The Examiner nevertheless asserts, without pointing to any support, that it is "well known in the art to make paste with particles including white ceramics with certain diameter and oil having certain viscosity." It is respectfully pointed out that

[1] It appears that only the abstract of Honjo has been cited. If the Examiner is relying on more than the abstract of Honjo, a translation is respectfully requested. See MPEP 706.02 II.

"'rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'" KSR International Co. v. Teleflex Inc., 82 USPQ2d 1385, 1396 (2007). It is respectfully submitted that the rejection of claim 9 rests on a mere conclusory statement that is not sufficient to support a rejection under 35 USC 103.

In addition, it is respectfully submitted that, in any event, it would not have been obvious to modify Honjo to achieve the features of the past recited in amended independent claim 9.

The Abstract of Honjo (which is all that the Examiner has relied on) merely discloses that "[t]he paste is prepd. by (1) mixing a low mol. wt. curing resin with a curing agent and crosslinking agent to prepare a binder, and (2) mixing the binder with a magnetic powder, a pigment and a surfactant, in a homogeneous kneading step." That is, the Abstract of Honjo merely discloses a paste which is prepared by mixing a binder with a magnetic powder, a pigment and surfactant.

As explained in the Amendment filed on March 1, 2010, Honjo discloses at column 1, lines 11-21 that when a magnetic current flows through a metal having magnetism, magnetic power sprinkled thereto will adhere to defective portions, thereby making

detection of the defective portions easier. As also explained in the Amendment filed on March 1, 2010, Honjo discloses at column 3, lines 32-40, an alternate embodiment in which when the paste is distributed in water, the magnetic particles are surrounded by the coloring agent, thereby making it easier to see where the magnetic particles are deposited on the metal. And as pointed out in the Amendment filed on March 1, 2010, a magnetic flaw detector is a necessary element in all of the embodiments disclosed by Honjo.

Honjo does not disclose or suggest a paste to be applied to a desired portion of a base material for at least one of restraining fatigue crack growth in the base material and detecting fatigue crack in the base material, as recited in claim 9. Indeed, as the Examiner recognizes, Honjo does not disclose the structural features of the paste recited in claim 1. As explained below, these structural features yield particular advantageous effects and are not at all suggested by or obvious in view of Honjo.

Particle Diameter

According to independent claim 9, the paste comprises particles having diameters of 2 μm to 40 μm. The particles having diameters of 2 μm to 40 μm in the paste recited in claim 9

can extend the failure life of the base material by a "wedge effect," in which the particles enter the crack and form a wedge that prevents the crack from closing, as illustrated in Fig. 2 of the present application. The crack can, as a result, be prevented from growing due to opening and closing of the crack. See page 10, lines 13-16.

If the particles in the paste have diameters larger than 40 μm, it is difficult for the particles to enter inside of a fatigue crack of a base material. As a result, the particles almost lose their effect of extending the failure life of the base material. See, for example, symbol Δ in Fig. 3, and the disclosure at page 9, lines 8-14, of the present specification.

On the other hand, if the particles in the paste have diameters less than 2 μm, an opening width of a fatigue crack in the base material is much larger than the diameters of the particles, and the particles have difficulty achieving the wedge effect. Submitted herewith is a reference figure illustrating a COD (crack opening displacement) δ (μm) versus a fatigue crack length (mm). In the reference figure, "PL-1" represents a sample to which no paste is applied, and "PL-2" represents another sample to which an alumina paste is applied. Referring to "PL-1" in the reference figure, even in the case of a very small fatigue crack having a fatigue crack length of 0.5 mm, the crack opening

displacement is well over 2 μm. It is respectfully submitted, therefore, that the wedge effect cannot be achieved by using particles having diameters less than 2 μm.

In addition, if the particles in the paste have diameters larger than 40 μm and as a result have difficulty entering a fatigue crack in a base material (as noted above), the particles are unable to grind a surface of the fatigue crack. It therefore becomes very difficult to detect the fatigue crack based on a change in color generated by movement of base material powder to a surface of the paste.

On the other hand, if the particles in the paste have diameters less than 2 μm, the opening width of the fatigue crack is much larger than the diameters of the particles (as noted above). Accordingly, when the particles enter inside of the fatigue crack, the fatigue crack can freely open and close, and the surface of the fatigue crack is hardly ground. In this case as well, therefore, it is very difficult to detect the fatigue crack based on a change in color generated by movement of base material powder to the surface of the paste.

Thus, it is respectfully submitted that the claimed particle diameter range of 2 μm to 40 μm achieves particular advantageous results and is not at all suggested by or obvious in view of Honjo.

Particle Hardness

According to amended independent claim 9, the particles comprise a material having a Vickers hardness of not less than 200 Hv. With this feature, the particles can grind cracks in a large number of base materials, such the resulting powder of the base material can move to the surface of the paste and be used to identify a crack. For example, a paste using particles having Vickers hardness of not less than 200 Hv, as recited in claim 9, can be effectively applied various base materials, including hte following base materials:

Carbon steel for general structures (SS400) Hv = 125

Carbon steel for mechanical structures (S20C) Hv = 160

Stainless steel (SUS304) Hv = 200

Stainless steel (SUS316) Hv = 200

Stainless steel (SUS430) Hv = 183

Aluminum alloy for weld structures (A5083) Hv = 80

Extra super duralumin (A7075) Hv = 170

Phosphorous-deoxidized copper (C1220H) Hv = 100

Accordingly, the paste recited in amended independent claim 9 can be used with various materials for marine structures, bridges, pressure containers, aircrafts, and so on.

It is respectfully submitted that Honjo does not disclose or suggest the structure recited in claim 9 whereby the particles

comprise a material having a Vickers hardness of not less than 200 Hv.

Indeed, Honjo discloses using a magnetic powder. The specification and Fig. 3 of the present application disclose a test result using magnetic particles (Fe). If a magnetic particle paste using magnetic particles (Fe) having a Vickers hardness of less than 200 Hv (Vickers hardness of 120 Hv, corresponding to the symbol ○ in Fig. 3) is applied to a base material, the life extending effect is much reduced as compared with, for example, the case where an alumina paste using alumina particles (Al_2O_3) having Vickers hardness of 1500 Hv (the symbol ▽ in Fig. 3) is applied. See Fig. 3 of the present application.

In addition, if a magnetic particle paste using magnetic particles (Fe) having a Vickers hardness of 120 Hv is applied to a base material, the particle has difficult grinding a fatigue crack in the base material. It is therefore very difficult to detect the fatigue crack based on a change in color generated by movement of base material powder to a surface of the paste.

Thus, it is respectfully submitted that the claimed Vickers hardness range of not less than 200 Hv achieves particular advantageous results and is not at all suggested by or obvious in view of Honjo.

Oil Viscosity

According to independent claim 9, the paste comprises an oil having a viscosity of 5,000 centipoises to 15,000 centipoises.

If the oil in the paste has a viscosity less than 5,000 centipoises, even if the oil is mixed with the particles having diameters of 2 μm to 40 μm it is difficult to realize a good paste state. Even if the oil enters the inside of a fatigue crack while the fatigue crack opens and closes, the particles are not transported by the oil but rather remain outside of the fatigue crack. As a result, the failure life extending effect of the paste is much reduced.

On the other hand, if the oil in the paste has a viscosity larger than 15,000 centipoises, the oil can be mixed with the particles having diameters of 2 μm to 40 μm to realize a paste state. However, if the oil in the paste has a viscosity larger than 15,000 centipoises, even when the fatigue crack opens and closes the oil has difficulty moving into the fatigue crack. That is, the pumping action accompanied by opening and closing of the crack and the capillary phenomenon at the crack tip, described at page 6, line 23, to page 7, line 2, of the present specification, are not performed. As a result, the particles are not transported into the fatigue crack, the failure life extending effect of the paste is much reduced.

In addition, if the oil in the paste has a viscosity less than 5,000 centipoises, even if the oil is mixed with the particles having diameters of 2 μm to 40 μm, it is difficult to realize a good paste state (as noted above). Even if the oil enters the inside of a fatigue crack while the fatigue crack opens and closes, the particles are not transported by the oil but rather remain outside of the fatigue crack. It is therefore very difficult to detect the fatigue crack based on a change in color generated by movement of base material powder to a surface of the paste.

On the other hand, if the oil has a viscosity larger than 15,000 centipoises, even when the fatigue crack opens and closes, the oil has difficult moving into the fatigue crack (as noted above). As a result, the particles are not transported into the fatigue crack, and it is therefore very difficult to detect the fatigue crack based on a change in color generated by movement of base material powder to a surface of the paste.

Thus, it is respectfully submitted that the claimed oil viscosity range of 5,000 centipoises to 15,000 centipoises achieves particular advantageous results and is not at all suggested by or obvious in view of Honjo.

Claim 10

Claim 10 recites that the particles comprise light-colored ceramics including white ceramics. The Examiner asserts, without any support, on page 2 of the Office Action that "it is well known in the art to make paste with particles including white ceramics." It is respectfully submitted that this unsupported assertion is not sufficient to support an obviousness rejection.

In addition, it is respectfully submitted that Honjo does not disclose or suggest the feature recited in claim 10.

Claims 11 and 12

New claims 11 and 12 recite that the oil comprises silicone grease. As a result, the oil's viscosity varies little due to temperature change. See the disclosure in the specification at, for example, page 6, lines 20-22. It is respectfully submitted that Honjo does not disclose or suggest the feature recited in claims 11 and 12.

* *

In view of the foregoing, it is respectfully submitted that the features recited in independent claim 9 are not disclosed by or obvious in view of Honjo, and achieve particular effects that also are not disclosed by or obvious in view of Honjo.

Entry of this Amendment, allowance of the claims, and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

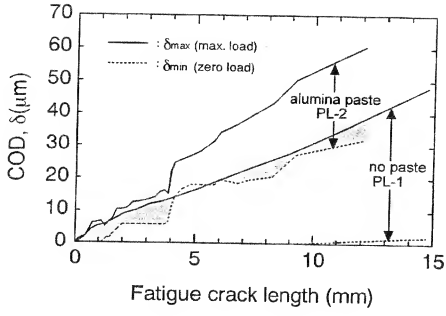
Respectfully submitted,

/Douglas Holtz/

Douglas Holtz
Reg. No. 33,902

Frishauf, Holtz, Goodman & Chick PC
220 Fifth Avenue - 16th Floor
New York, New York 10001-7708
Tel. No. (212) 319-4900

DH:iv/dd



COD (Crack Opening Displacement) versus fatigue crack length.